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A CASE OF ESOPHORIA AND PSEUDO-MYOPIA CORRECTED WITH BASE-IN KRATOMETER TREATMENTS, BASE-IN CORRECTIONS AND BIFOCALS*

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The case report I am about to submit for your consideration is interesting from several angles. In the first place, it deals with that so-called puzzling esophoric-pseudo-myopic type so frequently encountered. They either are just beginning to wear minus, if at all, or have reached that period of near-nervous collapse brought about through wearing increasingly stronger minus, as vision gradually drops, owing to the imbalances created, a vicious circle, so to speak. It is interesting, too, because it is a typical Spinal-Sympathatic type of case.

Case History. October 22, 1927. Case No. 11175. A school teacher, Miss J. B., age 24, from a neighboring town. Light blond, slight of build, forehead heavily lined horizontally, large pupils, narrow P. D. 57 m/m., extremely nervous, unable to do close work for any length of time. Wore glasses (no record but suspect minus) up to June, proceeding this record. Complained of frontal to occipital headaches coming on from one to two hours after starting work. Some photophobia, no inflammation of sclera or lids, no indication of teeth, antrum or sinus trouble. On verge of nervous breakdown, remarked to several teachers during week, "I will have to give up my school work Friday; I cannot stand this any longer." She was urged by a fellow teacher, a former patient, to have her eyes examined before resigning, and on her advice an appointment was made, when the above history was recorded.

Examination. Results of first examination as follows: campimetry examination, a general interlacing with slight contraction for all colors, showing a toxic condition. Blood pressure, Systolic 118, Diastolic 64. Pupillary reaction to light fair. Versions normal. Red free (green) reaction on red letter E at twenty feet equally slow for both eyes.

*An abridgement of the material presented before the American Academy of Optometry at Chicago, Ill., December 2, 1928.

Digressing for a moment, I find this is a very valuable check test. I use the genothalmic unit, and taking a red free glass (the green), place it quickly before, say, the right eye, at the same time asking whether the "E" changes color. It will surprise you in how many cases the patient will say, "There is no change whatever" or they will say, instantly, "Yes, it is changing color, it is black." I next try it on the other eye. The patient will many times say, "No, it does not change at all," and you will have to cover the right eye before you get a change, showing the left eye is not working properly, because if the two eyes are working together you will get an instant change of color before either eye, because, as you know, the brain cannot fuse the red and green.

Ophthalmoscopic findings normal, a beautiful picture. V. A. O. D. 20/20-2. O. S. 20/30-1; 3Δ esophoria, ½Δ L. H., slight suspension of vision in O. S.

Dynamic skiametry at 15 in. zero until 9Δ base-in prisms were placed in phorometer, resulting in O. D. plus 1.50 D. Sph., O. S. plus 2.00 D. Sph. visual acuity through same, gave O. U. 20/150.

It may be new to some, the taking of visual acuity through the dynamic findings. To me it is very significant, and very valuable. If your visual acuity is equal, you have a balanced finding, you know your work is correct. This, I believe, shows a balanced condition, each eye being reduced to the same degree. If the findings are accurate the visual acuity of each eye should be practically equal, regardless of inequality of the refraction. This holding true even in amblyopic cases, providing same be due to refractive errors, hence its diagnostic value.

The physiologic exphoria through the above findings after the 9 base-in prisms had been removed was 1Δ. Abduction for near 20Δ, subjective findings O. D. plus 0.50 D. Sph. O. S. plus 1.00 D. Sph. ⊃ 2Δ base-in O. U. gave 20/20? Abduction for distance 9Δ. Kratometer findings with F-L card gave E with a total base-out prism of 30Δ down to 4Δ.

The circle diamond test. I gave this to Dr. R. M. Peckham in Detroit last January; he was working on the cross-cylinder method, and ran into a case of hyperphoria that took some time to discover. I spoke up and said, "Why don't you use a circle diamond test?" This test will tell you instantly whether you have any hyperphoria at the near point, and it will bear it out for distance. I said, "If you will draw a circle on a Kratometer card about ten millimeters in diameter, and draw a diamond over here, seventy millimeters from the circle, the diamond being ten by twenty millimeters in size, if the circle has a tendency to go above or below, it will show positively a hyperphoria." If, in the normal case, you reduce your prism about one-half, you then have five on each eye, and the patient will hold the circle on the diamond. The test is quickly made, and will show your tonus.

In this case, the circle diamond test brought the circle to center of diamond, with a total base-out of 6Δ ⊃ with ½Δ base-down over O. S. This corresponds with the distant hyperphoria findings.

I did not complete examination on first visit. Making a re-examination on October 26th, the results of which were the same, I then prescribed 1½Δ base-in O. U. for temporary wear, along with Kratometer base-in treatments twice per week.

From now on I will describe the technique used and also show the progress made from time to time. I will say in explanation that at the time I was not recording abduction and adduction by the break and recovery method as at present, but recorded the total holding power only, so the greater part of the record will show it thus. It being an esophoric and pseudo-myopic type of case, induction was taken but occasionally, merely as a check.

I will first describe the record card used in recording the data necessary in these cases. I use a five by eight inch card with vertical and horizontal rulings on it. The vertical rulings have the following headings:

1. Treatment number.
2. Date.
3. Phoria.
4. Abduction, at 6 meters.
5. Adduction, at 6 meters.
6. Acuity of vision with a plus 1.00 D. Sph. over correction.
7. Physiological Exophoria, with plus 1.00 D. Sph. in place.
8. Abduction at 33cm.
9. Adduction at 33cm.
10. Notation.

The data, as recorded in this case, as taken from a card similar to the above is as follows:

October 22nd, 1927. Results of first examination showed 3Δ of esophoria and ½Δ left hyperphoria. Abduction for distance, 9Δ minus, for near, 20Δ. Vertical ductions, supra, and infra equaled, 1.50Δ even, for each eye. This does not show tendency toward true hyperphoria. The Kratometer examination with F. L. card gave E immediately, and continued to hold E up to 15Δ base-out O. U. and down to 2Δ base-out O. U. In the circle and diamond test, the circle was brought to center of diamond with 3Δ base-out O. U., combined with ½Δ base-down over left eye. Base-in Kratometer treatments were given each visit to relax tension and to reduce the esophoria.

October 26th, 1927. Patient showed the same amount of esophoria and hyperphoria. Abduction for distance 9Δ minus. Induction 22Δ plus. The plus 1.00 D. Sph. check lens gave visual acuity O. D. 20/70, O. S. 20/50. With this in place, resulted in 4Δ physiological exophoria. Abduction for near 15Δ, Induction 22Δ. A prescription of 1½Δ base-in O. U. was given for constant wear.

October 29th, 1927. Patient reported a lot of comfort from the above prescription. Findings taken over prescription as worn, gave same phoria findings as before, ½Δ left hyperphoria and 3Δ esophoria. Abduction 8Δ minus. Plus 1.00 D. Sph. gave visual acuity O. D. 20/60, O. S. 20/40 with 5Δ physiological exophoria. Abduction for near 18Δ. Gave in a fit over, plus 0.75 D. sphere O. U. to wear constantly, visual acuity through same equaled, right eye 20/33, left eye 20/20.

November 3rd, 1927. Patient complained of no trouble after first day. Not nearly so nervous. Did not tire so easily. Phoria findings for the last time showed ½Δ left hyperphoria also 4Δ esophoria. Abduction 9Δ minus. Plus 1.00 D. Sph. check lens equaled O. D. 20/133 and O. S. 20/70, this over last prescription, 5Δ physiological exophoria and 19Δ abduction for near. Made no change in prescription.

November 5th, 1927. 4Δ Esophoria. Abduction 8Δ, Induction 22Δ plus. Check lenses gave O. D. 20/100, O. S. 20/70. Abduction for near 20Δ. Gave prescription O. D. plus 0.50 D. Sph. ⊂ 1Δ base-in and O. S. plus 1.00 D. Sph. ⊂ 2Δ base-in. Had same on hand in treatment lenses.

November 12th, 1927. 3Δ Esophoria. Abduction 8Δ plus. Check lenses gave 20/70 O. U. Abduction for near 22Δ. Dynamic Skiametry O. D. plus 2.00 D. Sph., and O. S. plus 2.50 D. Sph. gave 20/200 O. U. Patient reported no headaches and getting along fine.

November 19th, 1927. 4Δ Esophoria. Abduction 9Δ plus. Check lenses gave 20/70 O. U. with 6Δ physiological exophoria and 20Δ abduction for near. Pupils somewhat smaller. Morale and general physical condition much improved.

December 3rd, 1927. 3Δ Esophoria. Abduction 10Δ. Check lenses gave 20/70 O. U. Abduction for near 18Δ. Naked vision O. D. 20/20, O. S. 20/25. With old prescription 20/20 O. U. Gave in new prescription O. D. plus 0.50 D. Sph. ⊂ 2Δ base-in, O. S. plus 1.00 D. Sph. ⊂ 2Δ base-in.

December 10th, 1927. 3Δ Esophoria. Abduction 8Δ. Check lenses gave 20/70 showing a balanced condition still. Near abduction 20Δ. Patient reported a gain of four pounds in past month. Only 1Δ esophoria showed up after Kratometer treatment.

December 17th, 1927. 2Δ Esophoria. Abduction 8Δ plus. With check lenses gave 20/70. Abduction for near 20Δ. Continued close work tires after a time. May have to give bifocals.

January 7th, 1928. 1Δ Esophoria. Abduction 8Δ plus. Check lenses gave 20/70. 6Δ Physiological exophoria. Abduction for near 22Δ. Visual acuity through prescription gave 20/20. No more plus was accepted. Dynamic skiametry gave plus 2.00 D. Sph. O. D. and plus 2.50 D. Sph., O. S. equaled 20/200 O. U. without prisms.

January 12th, 1928. 3Δ Esophoria. Abduction 12Δ. Vision through check lenses gave 20/70. Near point abduction 24Δ. This test was made with spheres only. Patient accepted plus 2.00 D. Sph. O. U. additional with cross cylinder at near point. Visual acuity was 20/200 O. U.

January 28th, 1928. 1Δ Esophoria. Abduction 9Δ. Vision through check lenses gave 20/70. Near abduction 24Δ. Patient reported no discomfort other than close work.

February 25th, 1928. 1Δ Esophoria and 1Δ left hyperphoria. Abduction for distance 10Δ. Vision through check lenses gave 20/70. Abduction for near 25Δ. Patient slightly dimmed for distance but comfortable. Advised bifocals.

March 24th, 1928. 2Δ Esophoria. Abduction for distance 9Δ. Vision through check lenses gave 20/70. Abduction for near 26Δ. Ordered bifocals O. D. plus 0.50 D. Sph. ⊂ 3Δ base-in. O. S. plus 1.00 D. Sph. ⊂ 3Δ base-in, plus 1.00 D. Sph. add O. U. for reading.

May 19th, 1928. 3Δ Esophoria. Abduction for distance broke at 8Δ back at 7Δ. Vision through check lenses gave 20/70. 6Δ Physiological exophoria. Abduction for near broke at 24Δ back at 22Δ. Patient feeling fine. Glasses did not give more than an hour's discomfort.

June 19th, 1928. Abduction 8/7Δ. Vision through check lenses 20/70. Abduction for near 24/22Δ. Patient doing nicely. To report again when school starts in fall.

November 3rd, 1928. Owing to teaching in distant city could not come in sooner. Have had no discomfort, have gained 10 pounds in past few months, perfectly satisfied. Distant vision through glasses was slightly fogged, owing to discontinuance of Kratometer treatments. A minus 0.50 D. Sph. clears up distant vision. But the same amount in plus would have to be added to the bifocal segment. Being comfortable, she decided to let well enough alone. Results of last examination showed 3Δ esophoria. Abduction 8/4Δ, induction 20/14Δ. Vision through check lenses 20/100 plus. Physiological exophoria 6Δ. Abduction for near 24/16Δ, induction 20/8Δ

Conclusion.

The results gained in this case were relief from headaches; morale regained; health restored, a gain of four pounds, reported in a little over a month; pupils reduced in size; nervousness eliminated, and for the first time in years able to enjoy reading and do close work without discomfort. A further gain of ten pounds so far this year was reported when the last examination was made November 3rd.

The baneful influence of esophoria can be checked by base-in prisms when same are intelligently prescribed, as the experience of the writer can testify in not alone one, but in many cases.

This might be of interest also, though it is not in connection with this case but it might come up in the future discussions. I use bifocals in all my strabismus cases. I think Dr. E. G. Wiseman does too. That is one of the first things I prescribe.

And another point of importance, I wonder how many present of our members take note of the condition of the forehead. To me that is one of the most significant diagnostic points that we have. The lined forehead, horizontally and vertically. That means eye strain as in the case just reviewed, if horizontally lined, and invariably a muscle imbalance, if lined vertically.

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CONVERGENCE AND PHYSIOLOGICAL EXOPHORIA: A CRITICISM AND REFORMULATION*

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It seems to the writer that much of our current interpretations of near point tonacity tests is based on dubious assumptions that are by no means self-evident. It is curious to note that investigators follow one path of reasoning when interpreting the behavior of the ciliary muscle and another path when interpreting the behavior of the extrinsic muscles. Yet there is no reason why this should be so. The very fact that the unit of muscular effort in both cases is called by the same generic name (the diopter) would seem to imply that in the minds of the original investigators, at least, such discrepancy was not intended.

Take for example the problem of physiological exophoria. The prevailing interpretation seems to be that of Sheard, an interpretation that we believe to be erroneous. Sheard agrees with Maddox that it represents convergence insufficiency and that the amount lacking is supplied by hypothetical fusion convergence centers. To quote Sheard:[1a] "Experimentation by von Graefe, Maddox, Howe, Worth, Theobald, Eberhardt, the writer and others has demonstrated that, in the average case, 'if one eye be covered while the other is fixing a near object, the occluded eye will in the majority of persons who are neither hypermetropic nor presbyopic, deviate outwards about three to four degrees.' *These researches demonstrate, therefore, that under normal conditions binocular single vision is not obtainable at points close to the eyes solely through the medium of the convergence as associated with the act of accommodation.* (Italics ours.) This deficit or difference between the actual convergence demanded for binocular single vision at any near point—let us specify the ordinary thirteen-inch reading distance as that point—and the convergence as supplied through the innervational channels associated with the accommodation, is known as *physiological exophoria.* In order that binocular single vision may ensue, it is necessary that this deficiency be overcome by a visual reflex action, or *fusion reflex.*

"Normally, therefore, we should not expect binocular single vision to be obtained except through the supply of some three or four degrees of fusion convergence from a source or center wholly independent of the accommodation."

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Now it will be noticed that there are two premises on which Sheard bases his conclusion: (1) that the physiological exophoria is a defect or convergence-insufficiency; (2) that convergence is of two kinds, accommodative and fusional. It is the claim of the writer that both of these assumptions are erroneous.

In regard to the first premise, it seems obvious that there is a confusion between the concepts of an exotropia and an exophoria. Only in the case of an exotropia is there an insufficiency of the convergence. When the eyes are dissociated in the near point tonicity test, it may be that they naturally relax since there is no fusional need for convergence. It is as if the military command were given: "At rest!" Why should normal eyes not relax when they are so strongly encouraged to do so and when there is no reason why the internal rect should maintain their tension?

This relaxation when the eyes are dissociated is analagous to the acceptance of plus power by the ciliary muscles in dynamic skiametry. We are not surprised when the eyes surrender some of their burden of accommodation to the lenses inserted in the trial-frame. Why should we be surprised when the internal recti relax as the necessity of fusion is eliminated? The amount of plus power that can be added before reversal of the shadow in dynamic skiametry does not necessarily represent the amount *needed* by the eyes; it is, I believe, merely the amount that the eyes are willing to surrender. Similarly, the amount of exophoria at near that is revealed by the tonicity test does not necessarily represent a deficiency of convergence, as Sheard and others interpret it, but the *capacity of relaxation.*

In regard to the second premise, that convergence is of two kinds, accommodative and fusional: it seems to the writer that this hypothesis is an unnecessary and dubious one. It is unnecessary because it is possible to explain convergence phenomena just as adequately without it. It is dubious, if not demonstratably erroneous, for two reasons: (1) According to this theory, it is necessary to postulate the existence of a fusional center that is, as Sheard says, "wholly independent of the accommodation." According to the latest researches into the histology of the oculomotor nucleus, no such separate center exists.[2] (2) It has been amply demonstrated that fusion is a *psychic* phenomenon and as such, may be independent of convergence. For example: Worth has shown that fusion is possible to a limited extent even when the images are *not* on corresponding points of the retinas.[3] This point had been previously demonstrated by Helmholz,[4a] Wheatstone, Rogers and Wundt succeeded also in fusing after-images that were not on corresponding places on the retinas.[4b] The psychic nature of the faculty of fusion is particularly shown by the results obtained when we try to fuse two images which are wholly different from each other in appearance. What we see in these cases depends largely on the degree of attention and mental concentration with which we fix a particular part of the fused image. For example, to take a simple case, if a pair of vertical lines is fused with a pair of horizontal lines, only certain parts of these lines will be visible at certain times; then again as

we gaze at them, other parts will appear. If, however, we fix our attention on one pair of lines only, it will maintain its visibility without flickering out,[4c] unless our attention wanes. To quote Worth, referring to his own experiment: "This experiment would serve as a proof, were any needed, that fusion is a *purely psychical* process, and not merely the result of stimulation of corresponding sets of nerve endings in each retina." (Italics ours.)[3]

The writer claims that it would be more scientific to use the term "convergence" without ever modifying it with the qualification "accommodative" or "fusional" which depend for their validity on *à priori* assumptions. He has shown elsewhere[5] that there are strong grounds for believing that it is only in exceptional cases that the accommodation-convergence relationship is a reflex one and that normally they operate independently of each other. Hence he would eschew the term "accommodative convergence" which connotes a reflex and thus begs the question. The fewer assumptions we make, the less risk there is of error. For this reason it is suggested that we postulate only *one kind of convergence* in all cases, and we can define this as the faculty of rotating both eyes in such a manner that the images will fall on corresponding parts of the retinas, the assumption being that (normally) fusion is impossible under any other conditions and that fusion is for some reason an imperative need secured reflexly by the higher brain-centers. The degree of this convergence may happen to coincide with the degree of accommodation or it may not, depending on the individual requirements of accommodation and convergence. It should be remembered that the innervational centers for the accommodation and the convergence are separate in the oculomotor nucleus.

In support of his interpretation of fusion as a supplementary source of convergence-innervation, Sheard has claimed that the punctum proximum is nearer when both eyes are engaged than when each eye looks at the object separately.[1b] The inference, of course, is that the increased innervation accruing from the operation of fusion results in a greater power of convergence and hence in a greater power of accommodation.

Now the writer investigated this point as follows:

He fitted up an apparatus consisting of the chin-and-head rest of an ophthalmometer and a meter stick divided into millimeters. The subject is seated with his chin on the rest. One eye is occluded and he is directed to gaze at the letter "o" on a card attached to a rider which can be moved along the stick until the letter is definitely blurred as it comes nearer and nearer. The stick is midway between the two eyes and the letter is a little below the plane of the eyes. It is illuminated evenly by a light placed directly above the head of the subject. The operator notes the distance in millimeters at which the letter first becomes definitely blurred. Then this eye is occluded and the near-point of the other eye is ascertained in the same way. Finally, the experiment is repeated with both eyes fixed on the approaching letter. The whole experiment is repeated three times and the mean readings determined. The subject is made emmetropic before

the experiment by the use of corrective lenses. Also, care was taken to select only individuals with single, binocular vision and unimpaired fusion sense, for which they were tested out beforehand with a Black-Worth amblyoscope.

Out of 10 people whose near-points were thus investigated, in *only three cases* was the punctum proximum *nearer* for both eyes than when each eye was tested separately, as Sheard claims. In the remaining seven cases, the near-point of each of the eyes (which often differed from each other) was substantially nearer than the near-point of both eyes.

The writer earnestly hopes that other investigators will repeat this experiment many times and announce their findings which have such an important bearing on the question of the influence of the fusion sense (if any) on the convergence and accommodation. It would be particularly revealing to perform the experiment in those cases (which the writer regards as relatively rare) in which the accommodation-convergence relationship is definitely reflex, as in cases where the eyes turn in when the hyperopic correction is removed.

To return to the question of exophoria at near, a simpler, more convincing hypothesis than fusion-innervation is, in the writer's opinion, as follows: When the eyes are dissociated at near, say with a displacing prism, revealing the exopheria, the internal recti might be merely in a state of "At ease," as suggested before. When, however, the prism is removed, the need for fusion results in the stimulation of the convergence-centers which send extra neuricity into the internal recti and the gap is covered. This is only one of several instances in the human body of direct psychic control over physiological functions. The degree of extra neuricity sent out by the convergence-centers under these conditions depends, I believe, upon the intensity of the fusion desire.

The advantages of this hypothesis over the prevailing one, then, are that it depends only on the two known facts of the existence of convergence-centers and the fusion demand, which is regarded as a psychic phenomenon. On the other hand, it does not have to postulate for its validity the existence of separate fusional centers, which the most exhaustive histological investigations have failed to disclose, or the reflex nature of the accommodation-convergence relationship in normal cases. As stated before, evidence has been gathered to show that the relationship is reflex only in a minority of cases and even in these cases the reflex is not organic but has probably developed by "conditioning" according to Pavlov's principles.[5]

Let us now apply our interpretation quantitatively:

According to Sheard, and as commonly interpreted, if there is an exophoria of 6 prism D. at 13″ and 19 prism D. are required for single binocular vision according to Prentice's rule, then two kinds of convergence come into play at this distance when the individual is reading. First there is the "accommodative convergence" which is 19 minus 6 or 13 prism D. "This 13 D.," writes Sheard, "is the difference between the 19 prism D. mathematically demanded and the 6 of *deficiency*." (Italics

ours.)[1]c. This so-called "deficiency" of 6 prism D. is covered by the other kind of convergence: fusional convergence.

According to our interpretation, there is only one kind of convergence. Thus Sheard's hypothetical case, the amount of convergence in use when the individual reads at 13″ is 19 plus 6 or 25 prism D., assuming of course that he has single binocular vision. Consider again an analogous situation with the ciliary muscle: In latent hyperopia of 1.00 D. with 20-20 vision without glasses, we do not consider the eye as deficient in accommodation. On the contrary, there is enough power in reserve to produce an excess accommodation of 1.00 D. at all distances. At 13″ the hyperope accommodates 4.00 instead of the normal 3.00 D. Similarly, in Sheard's case, the convergence-centers must supply 6 prism D. more of convergence than the amount normally required at that distance; and the fact that clear, comfortable vision is often obtained by normal eyes having 4 to 6 prism D. of physiological exophoria* proves ipso facto that they have enough convergence reserve to overcome this amount.

The fact that there is ample reserve does not mean that no strain is involved. The amount of reserve that can be drawn upon without discomfort varies among individuals. Now Landolt laid down the criterion that up to one-third or one-fourth of the amplitude of convergence can be continuously used for comfortable vision. Yet here again the writer would apply the results of our experience with ciliary muscles as a guide to procedure. It is well known that many individuals especially of the neurotic type, suffer from asthenopia if their accommodative reserve is forced to supply but a quarter of a diopter to overcome hyperopia even with normal amplitudes whereas, on the other hand, many young hyperopes can overcome 1.00 D. and more without the slightest discomfort. Now it is probable that it takes a higher error of heterophoria to produce asthenopia than ametropia; probably the demands of the ciliary are more important, at least immediately, than the demands of convergence. Nevertheless, the corrective principles are the same and the weakness of rigid, quantitative formulations like Landolt's is indicated by the frequent successful application of slight, base-in prisms even when the amplitude of convergence is normal. Quite often these prisms have eliminated the asthenopia when other methods had failed.

We have criticized the interpretation of physiological exopheria as a defect and suggested that it might be simply a measure of the *capacity for relaxation* of the convergence and we believe that this is all the exophoria represents in the majority of cases. However, in every case of physiological exophoria we ought to ask ourselves this question: Do the eyes *want to turn out relative to the point fixed even when they are engaged in the act of single binocular vision?* Never mind how widely they actually diverge in the dissociation test for near; never mind if the physiological exophoria is 4 prism D. or 14 prism D. This may represent nothing more

*More accurately the so-called physiological exophoria noted should be the net amount after the distance heterophoria from (or added to) the amount of heterophoria found at near.

than the convergence-relaxation, especially when the P. D. is relatively great. There are many individuals, as every experienced refractionist knows, who have 10 prism D. and even more of physiological exophoria which does not bother them at all. It is only when the eyes have a positive tendency to diverge when in normal use that the physiological exopheria has therapeutic signficance. We should discriminate between this kind of exophoria and the former kind. For this reason the writer suggests that the term "physiological exophoria" should be reserved only for reference to convergence-relaxation under the dissociation test at near and only in cases where there is no disturbing struggle to diverge in binocular single vision. (Another suggestion would be to eliminate the term "physiological exophoria" altogether from the refractionist's vocabulary and use the term *"pseudo-near-exophoria"** or *"negative near exophoria"* instead.) On the other hand, when the eyes want to diverge during the act of reading, the exophoria revealed at near should be called *"positive near exophoria"* or *"true near exophoria."*

Now how can we differentiate between negative near exophoria and positive near exophoria? The answer is: *Not by any quantitative standards.* The only criterion is the patient's report of his subjective reaction. Of three individuals, each showing 6 prism D. of exophoria at near (assuming orthophoria at distance), one may have negative exophoria, the other may have positive exophoria and the third might have 3 of negative and 3 of positive exophoria. Suppose we prescribe a lenticular correction for an individual and disregard his 12 prism D. of near exophoria. He may be entirely satisfied with his glasses which immediately eliminate his asthenopia. Along comes another individual requiring a lens correction with only 7 prism D. of exophoria at 13″. The glasses are delivered but the patient returns in a week or so with the complaint that he has asthenopia when reading. Suppose we incorporate weak base-in prisms with his correction and the asthenopia disappears. Then we know that the exophoria was of the *positive* variety just as the exophoria in the preceding case was negative. The question is not: "How much exophoria," but: *"Is this exophoria positive or negative?"*

The reader will note that in the hypothetical cases mentioned no reference was made to the amplitude of convergence. The reason for this is that we believe that in many cases the amplitude of convergence has no significance and is, in fact, liable to mislead us. Let us again turn for a parallel to the ciliary muscle. It is not at all uncommon for young men or women in their twenties to require ¼ or ½ D. spheres to relieve their asthenopia even though investigation reveals their accommodative amplitudes to be normal. It is not musclar strength of either the ciliary or the internal rectus, that is the determining influence of the patient's reaction but the innervational endurance. More important than the amount of "reserve power" is the nature of the individual's temperament, the degree of his self-consciousness, his awareness of his own sensations and

*The writer suggests that "near exo." is a more accurate term than "near-point exo." because "near-point" traditionally means the punctum proximum.

reactions. Especially in cases of neurasthenia, it is often found that "power in the eye-muscles initially is good but fatigue is rapidly induced."[7] In general, "each ocular muscle (extrinsic) possesses more power than is needed for an act which it is called upon to do."[6] Hence the causes of heterophorias and heterotropias are largely innervational.

Conclusions

Our interpretations of the behavior of the extrinsic muscles should follow the same path of reasoning as our interpretations of the ciliary muscle;

Physiological exophoria so-called may represent not a defect but a relaxation of convergence that can be changed into normal activity without strain;

We should eliminate the term "physiological exophoria" or else identify it solely with "negative near exophoria" in contra-distinction to "positive near exophoria" which alone has therapeutic significance;

It is impossible to differentiate positive from negative exophoria by quantitative means, the only indication being the subjective reaction of the patient;

It is unnecessary and unjustifiable to postulate the existence of the accommodative and fusional types of convergence, the only *raison d'etre* of convergence being the necessity of the images occupying corresponding points on the retinas;

There is only one kind of convergence-innervation and the degree of convergence-effort required at near for single, binocular vision in any case having near exophoria is equal to the sum of the required convergence-effort calculated according to Prentice's rule plus the amount of (positive or negative) exophoria;

The extent to which the convergence-reserve can be drawn upon without discomfort, varies among individuals so that Landolt's rule cannot be relied on, owing to the fact that the weakness is generally not muscular but innervational.

REFERENCES:

[1]Sheard, C., "Dynamic Skiametry and Methods of Testing the Accommodation and Convergence of the Eyes," 1920. (a) pg. 66; (b) pg. 59; (c) pg. 75.

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REPORT OF A CASE TREATED BY VERSION STIMULATION*

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The case I want to present to you is of a young man, 17 years old, who came to me through his family physician who shares a reception room with me. This is the history of the case.

Following an attack of influenza, he developed a discharge from the left ear. Several days later he found he was compelled to hold his head turned to the left with the eyes turned to the extreme right, otherwise diplopia occurred. His refractive error was: right eye plus 0.50 D. S. and the left eye plus 0.62 D. S. By occluding the right eye, which was the unaffected one, the left external rectus being the muscle affected, he was even then unable to control the left eye other than by short jerky excursions of a few millimeters with immediate return to the inner canthus after each attempt. When allowed to, the eye would remain at rest at its position in the inner canthus.

Using the myoculator method, there was an esotropia indicated of 95 degrees. I would give this procedure but to a group of myoculator users, it would be useless repetition, and to those who do not use this technique it would be valueless information, for its application is impossible without the instrument.

My treatment technique was as follows: The first few days I covered the right eye and exercised the left alone, the technique being the projection on a white screen. The movement was in the horizontal meridian in short slow excursions. The watching and following with one's eyes, of this bright spot of light in an otherwise dark room is almost irresistible with the result that he followed as best he could, turning his head mostly and his eyes some. I gave five-minute treatments with an hour rest between, from 9:30 in the morning until 4:30 in the evening. As he was able to stand it, I increased the training periods until they reached twenty minutes, but still retained the one hour rest period between treatments.

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*An abridgement of the material presented before the American Academy of Optometry at Chicago, Ill., December 4, 1928.

In four days, the esotropia was reduced to 65 degrees, the fifth day to 45, and the same afternoon down to 35, on the eleventh day it was 30; there it remained until the beginning of the final week of training, when it dropped suddenly to orthophoria.

In the first three weeks, we spent most of our training periods in simple straight line excursions in horizontal and oblique patterns. At first monocularly, then in the latter part of the second and most of the third week, binocularly. When working binocularly, we used the interrupter in the position, both blades straight forward, thus demanding alternate and equal excursions in both eyes, not that we got it for while that left eye tried valiantly and I might say violently, it just could not equal the right eye at first but with the right eye as a good example and the opportunity to do likewise being constantly presented, the left gradually improved.

The patient being from out of the city and having stayed away from home these three weeks, I allowed him a week's rest and sent him home.

The final week, which was the fourth week of actual training, was encouraging. The second treatment of the first day we had perfect motility in the left eye in every excursion, and in all patterns. When fusion was qualified, however, we found it very poor. This week was devoted entirely to the betterment of this condition. The green and red scopes were used with the white target, all manner of straight line patterns used with gradually increased speeds.

On Wednesday we started using the bi-chromatic targets, with the scopes, and by Saturday we had fusion in every position at minimum separation in the vertical and the maximum in the horizontal positions.

The patient was discharged to report back in three weeks, this he did reporting perfect comfort, the ability to walk straight and not bump into things when passing them, and delighted that he could again drive his car as his eyes had remained in perfect condition. I gave him a full day's treatment, using all the technique previously used. I had him return in two weeks again; this time we used mostly the exercises with the bi-chromatic targets and the scopes. I have seen him several times since, and on each occasion he reports perfect comfort and satisfaction.

I have thought considerably about this and other innervational cases, and their general similarity have made me ask myself a number of questions. They may be of interest and they may not, but with your forbearance I will give them to you.

Can we safely draw the following conclusions? Since the muscular defect remained unimproved after the ear infection cleared up, it would seem to indicate a toxic inhibition to the nerve supply of the muscle involved. To remove or destroy this toxemia would be of primary importance. To do so, it would be necessary to increase

the blood supply, which could be most readily accomplished by muscular activity, and this blood would be rich in nutritional value to build destroyed muscle material, also in oxygen to chemically break down the toxemia, making it possible to be thus carried away in the blood stream.

Now, to generalize, let us take two imaginary conditions. In this, I will admit our data unproved and possibly unrelated, but as we progress, is there not a definite similarity? In one case, we have an infection as the cause of toxemia. In the next case, we have a fatigue as the cause of the toxemia. In both cases, I believe, the toxemia would act as an insulator at the nerve terminal, as well as having a destructive effect on the muscle itself.

Let us look briefly to Knight Dunlap, regarding this. I will quote: "In the body, the circulation of blood both brings fresh food material, to build up new muscle material and also removes the waste products. If the muscle activity is relatively great, however, the waste product cannot be removed as fast as formed and either the food material is not brought fast enough, or else the muscle cell cannot fast enough build up muscle material out of it."

The author was not speaking of eye muscles in particular, but his statement applies to them as well as any others. Therefore, do not all our muscle troubles resolve themselves into two classes, one from infections of many bodily sources, and the other fatigue from eye strain.

Fortunately, our cases from infection are not numerous. In the other class, do not many of our extra-ocular defects disappear by merely the application of lenses, thereby removing the fatiguing element?

Are we sure that some of those cases that do not readily recover would not in time? Not that I advocate waiting to see, for the wait is unnecessary and unfair to our patients. But, it is possible that many would recover by themselves. I believe I am correct in saying that all our methods of hastening this recovery, by exercise, in different ways get muscular activity, thereby increasing the blood supply and hasten the normalizing of our muscle material and neural supply.

I admit the factor of fusion is not taken care of by this alone, but it is primarily important that the muscles be normal before the normal fusion can be realized.

Do not misunderstand me to mean that I minimize the importance of fusion, not at all. I feel that after that accident of fusion occurred at twelve months, which is the generally accepted age, the conscious recognition of that condition in the motor center of the brain becomes, and has through the centuries of man's existence become, such an integral part of seeing that while it is possible

to disturb it, I doubt that we ever lose it. In fact, those conditions which we choose to call fusional weaknesses are merely symptoms which should indicate to us disturbances in the relationship of the muscles, and shows that it is easier to suspend or partially suspend fusion than to attempt to drive a toxic-laden muscle, or muscles, into normal activity.

I do not mean that fusion is weakened, but that it acts as a safety valve to keep the motor center from attempting labors that would possibly have a very destructive effect on the brain itself. It would be interesting to study fusion in the mentally defective; it is barely possibly that an unyielding fusion may be very detrimental.

Going back to our subject, is not suspensopia a definite indication of what I have been saying, a short suspension would indicate that the motor center is being taxed less than when a long suspension is evident. When this strain is too great for even intermittent vision, we have the tropias, where we find total suspension. Cannot we construct a reasonable cause for strabismus from all this? The degeneration of a muscle from toxemia due to fatigue, from a refractive error and the resulting disturbance in the accommodative convergence act, or by a toxemia resulting from children's disease.

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THE SCHOOL CHILD AS VIEWED FROM HIS MENTAL AND VISUAL EQUIPMENT*

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When school examinations show that a child has not mastered his lessons, the interested parent usually wants to know whether it is due to a lack of incentive or dullness. The real cause of failure may not be easy to ascertain.

Of two children of the same age and in the same class, one must study hard in order to obtain a satisfactory grade, while the other scarcely looks into his books. They both get the same grade from the final examination.

A hard working teacher finds her pupils do not average high in their examinations, while another class of the same grade does much better under another teacher. What is the reason for this? Is she a poor teacher? Or does she by chance happen to have an unusually large number of stupid pupils? She may suspect the latter, but has no proof. It is not easy to tell the degree of intelligence of a person by his facial expression.

Alfred Binet, the French Investigator, was inspired by such problems as these to devise a scale for measuring native ability. Binet was primarily interested in determining the levels of intelligence of the individual child. For this purpose he arranged a small group of questions for each age up to 12 years. These problems were selected after he had determined that they could be answered by the majority of children of the age for which they were intended. He thus constructed a mental scale by which he could ascertain the child's "mental age."

If, for example, a child answers the questions up to and through the 12 year group, he is given the mental age of 12, this figure is then divided by the chronological age, and the result is called the Intelligence Quotient. The child of 10 should pass the 10 year group, receive a quotient of unity, or as it is expressed, an Intelligence Quotient of 100, which means he conforms in intelligence to the average of his age. If he passes the 12 year group, one divides 10 into 12, which gives 1.2, or an Intelligence Quotient of 120. Such a child may be considered somewhat above normal. An Intelligence Quotient of 60, which the child of 10 would obtain if he only passed the 6 year group, would class him sub-normal.

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When these tests were first used in America, it was found that certain parts of the scale were inadequate, the tests were therefore improved, and this new form was called The Standard Revision of the Binet Tests. These tests have been used extensively throughout the country. By means of them, it is said to be possible to determine whether a child is normal, sub-normal, or superior.

There being such an important and direct relationship between the organs of sight and the mental processes in gaining an education, one is often impressed with the visual conditions obtaining in the schools and the relationship these bear to mental advancement or retardation. It is a very common occurrence, indeed, to discover pupils who are backward and often indifferent about their school work, naturally due to some form of visual disturbance. Far sight, or hypermetropia and astigmatism, causing as they do excessive demands upon the ciliary muscles and resulting in headaches and other irritating, nervous effects; myopia (near sight) causing as it does indistinct vision when one looks at a distance, thereby slowing up the child's actions and mental reactions; defects of the ocular muscles, also causing extremely uncomfortable symptoms and in some instances actual deviation of the eyes.

Practically all ocular disturbances of any consequence unquestionably interfere with the free and easy use of the mental faculties. It is easy to understand and appreciate the causes in many instances for lack of desire to apply oneself, especially when not armed with fully adequate mental powers. Likewise, when visual conditions are below normal this adds to the difficulty. It is quite possible that erroneous Intelligence Quotient findings may be obtained in the case of a child with low visual acuity or lack of proper co-ordination of the eyes, as they can not possibly have the desire or incentive to use the eyes, therefore can not always be properly compared with the child who has normal eyes and uses them a great deal, thereby developing their mental powers.

Prof. Lewis M. Terman, in his Treatise, "The Hygiene of the School Child" says: "Excepting touch alone, the eye is the most valued of our special senses. The conservation of vision has been called 'more important than all the work of our universities.' At least one-fourth of the inhabitants of Europe and America are more or less handicapped by defective vision. Since most of the instruction given in the schools is based upon the visual impression, it is well to examine the efficiency of the visual functions to ascertain the effects of school work upon them."

We are told that 80 per cent of the child's education during the first 12 years of his life is acquired through use of the eyes.

In my work of conducting a school visual survey in Orchard Avenue School District No. 143 and West Valley High School, District No. 202, located in what is known as the Spokane Valley, a suburb of Spokane, Washington, I was first impressed with the case of a girl aged 14 who had been failing miserably in her school work and who, after visual correction of the Hyperopic-astigmatic defect of medium degree accompanied with

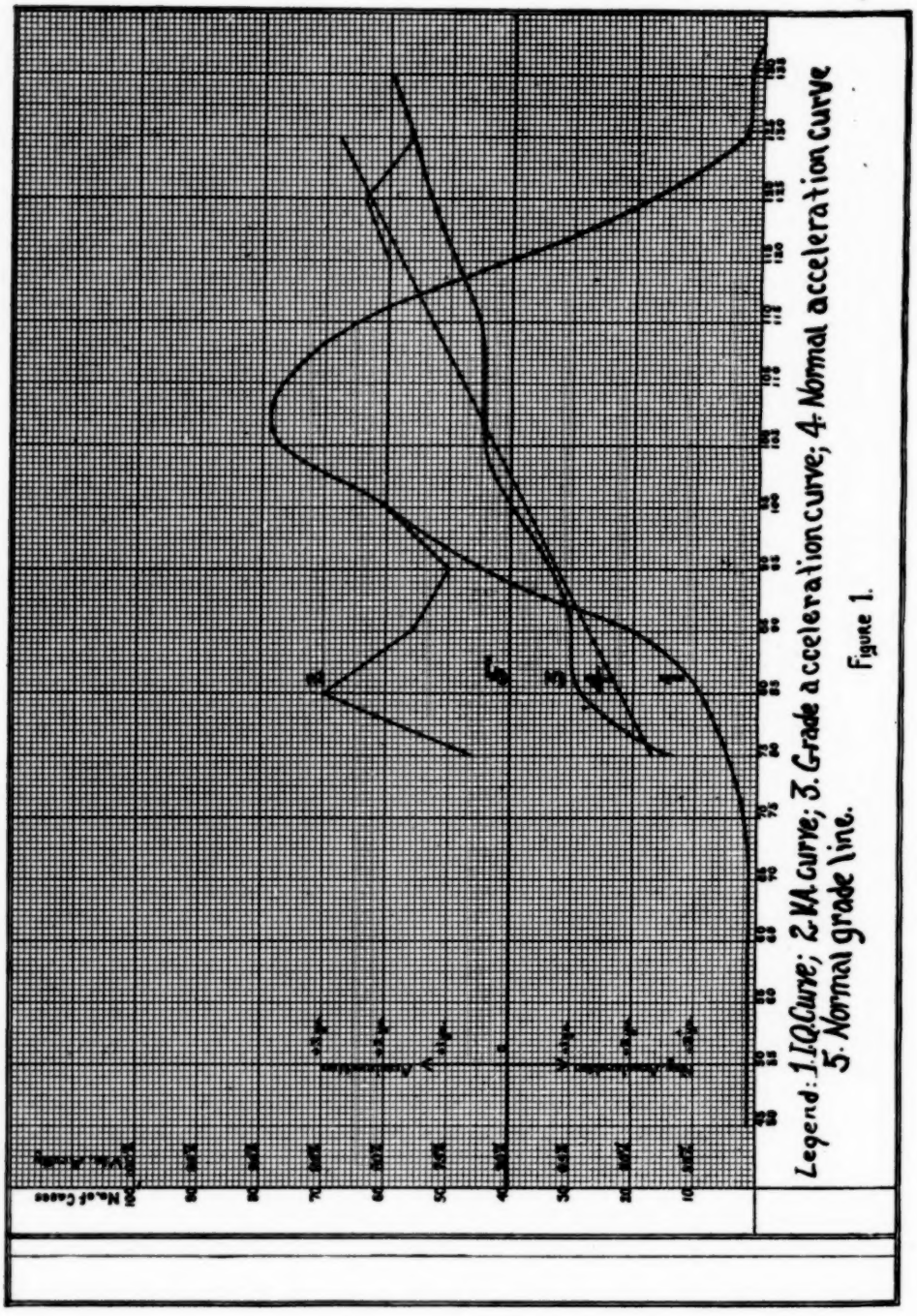

Legend: 1. I.Q. Curve; 2. M. curve; 3. Grade acceleration curve; 4. Normal acceleration curve
5. Normal grade line.

Figure 1.

an extrinsic ocular muscle unbalance, quickly took on acceleration in her school grades; also many similar cases in private practice which had gained so much ground after proper visual correction; I was impressed more than ever that other factors might well be included in this problem of the school child's vision which led to this investigation.

Through the wholehearted co-operation of Mr. A. B. Ness, the Superintendent of Schools in the District mentioned, the necessary data concerning the Intelligence Quotient was obtained and correlated with the data covering the survey, and we find a most interesting and striking state of affairs.

In the final result, we were able to arrive at what we considered a very fair evaluation of the correlation of Visual Acuity, Intelligence Quotient and Grade Acceleration. Without the I. Q., the V. A and Grade Acceleration does not mean very much.

The data bearing upon intelligence tests contained the following information in each instance: 1. School grade; 2. Age; 3. Intelligence Quotient. From this information each pupil was graded according to the following classifications: 1. Normal; 2. Years of retardation; 3. Years of advancement; 4. Mental age.

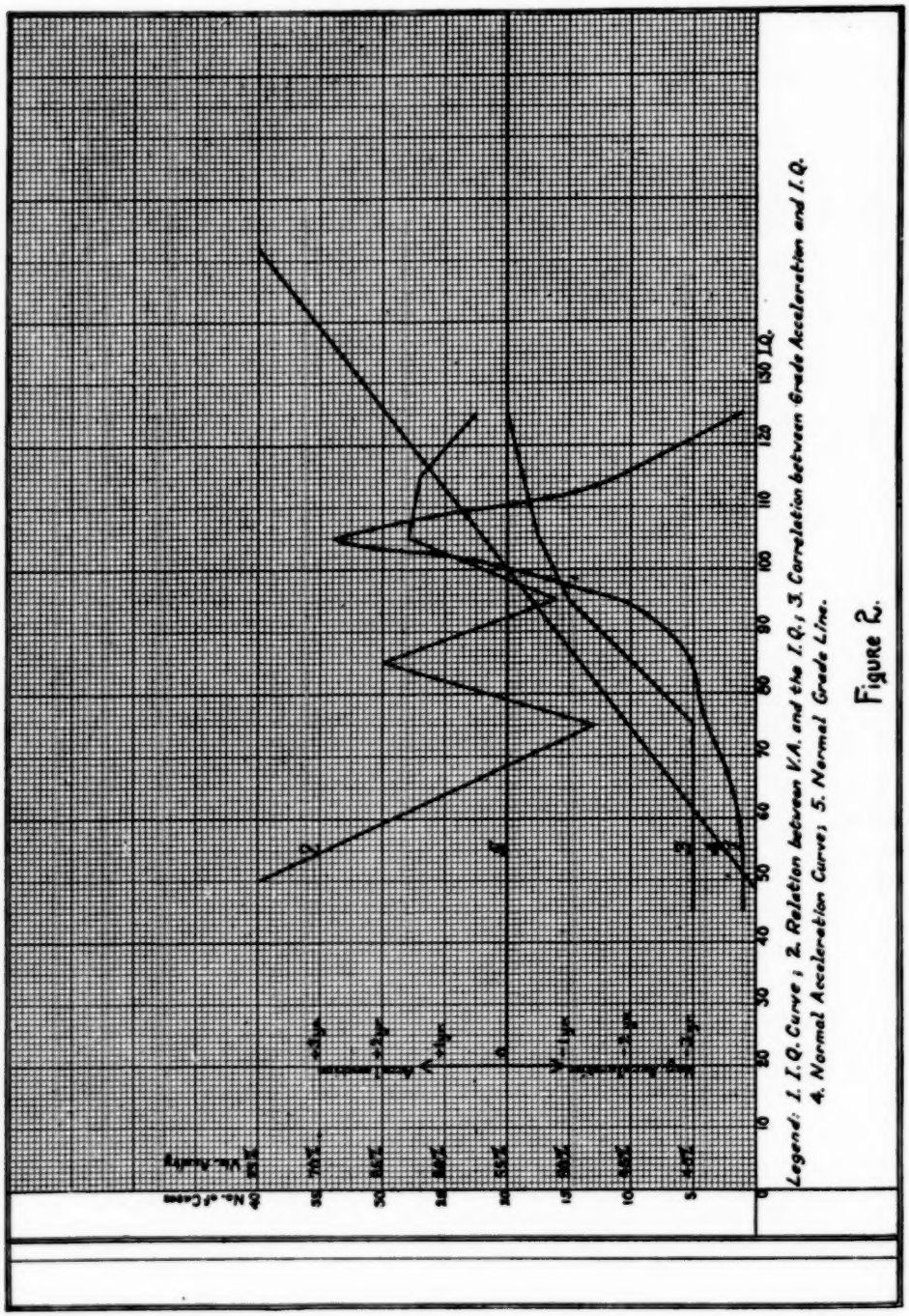
The Graphs shown here, when analyzed, indicate the results of conditions existing in what might be termed an average American urban school district, so far as the relationship between the vision and the mentality of the child is concerned, and as it affects the education.

The methods and equipment employed in making the eye tests are enumerated below, the equipment being employed and tests made in the order mentioned:

1. The Clason Visual Acuity Meter for ascertaining the true visual acuity of each eye separately, this being recorded in percentage.
2. The Ophthalmoscope for ascertaining the existence of pathological process within the eye; local inspection was also made at this stage of the tests.
3. Convergence near point tests; version tests.
4. Dynamic retinoscopy was employed, using a pair of plus 1.50 lenses in trial frame, fixation and working distance being at approximately fifteen inches. Any motion shown was estimated as to character and amount.
5. Subjective tests were made, based upon the findings by previous methods and the approximate amount of defect was recorded. This was followed by a phoria test, using a colored glass and dissociating prism.

The cards used in these tests contained the data called for above when abnormalities or defects were indicated. These cards, in addition, contained the name, age, and grade of the pupil.

The data for Graph or figure No. 1 was taken from a group of [illegible]



Legend: 1. I.Q. Curve; 2. Relation between V.A. and the I.Q.; 3. Correlation between Grade Acceleration and I.Q. 4. Normal Acceleration Curve; 5. Normal Grade Line.

Figure 2.

pupils, 195—approximately 45 per cent—being high school students, an average group of 100 cases being used. For various reasons, it was found to be difficult to get a true relationship between I. Q. and school grades in some instances, consequently these pupils were eliminated in making up the Graphs.

It is to be noted that the group between 110 and 120 I. Q. should average 1¼ years grade acceleration, yet they show an average retardation of ¼ year. The average V. A. being about 60 per cent of normal, the I. Q. group between 120 and 130 averaged normal, while they should average about 2 years acceleration, the V. A. in these cases averaging only 57 per cent.

Graph or figure Number 2 represents a group of 65 cases with eye defects taken as found and without selection as to grade, some being high school pupils and some grade school pupils.

Those between 40 and 50 I. Q. were decelerated or retarded, an average of 3 years, and V. A. (average) was 75 per cent. Those falling between 50 and 60 and also those between 70 and 80 I. Q. were 3 years behind. The V. A. it will be noted dropped to 48 per cent. This drop in V. A. doubtless is an important cause for at least some of the retardation. The 80 and 90 I. Q. groups were on an average of 2 years behind and the average V. A. shows 65 per cent. These pupils should not be so far behind and probably the vision is again an important factor. The 90 and 100 I. Q. groups averaged one year behind with a V. A. average of 51 per cent. The average should be no more than one-half year behind. Those in the 100 and 110 classification averaged one-half year behind and should show an average of one-half year acceleration. This group had an average V. A. of 63 per cent, which again shows up the weak spot.

It is to be noted that the majority of pupils with low I. Q.s are in the lower grades, as their age advances they drop out of school if they fall much behind (as they usually do), hence proportionately fewer are found in the high school grades.

Summing the situation up—it is apparent that defective vision plays an important role in retardation of the school child, the precocious child being retarded as well as the normal and sub-normal. The importance of correcting defective vision early in the child's life is obvious. If parents could only be brought to a realization of this important duty which they owe to their children. It is a very regrettable fact that with conservative figures of 25 per cent necessary eye correction cases existing in the average school, only about 5 per cent receive attention in the way of direct measures of alleviation. We have not only the humanitarian side of the story—the tremendous cost of educating these visually retarded children is an item of no small consequence. Upon a rough estimate of the financial side of the matter, we note that in this small group containing 429 school children, 21 per cent were absolutely handicapped by defective vision and retarded on an average of 1½ years. With an annual average educational cost of approximately $100.00 per student, we have

an annual average loss of $13,500.00, to say nothing of the loss in earning power of these individuals because of this retardation and the expense and loss sustained by the parents who must continue over this 1½ year period to provide the necessities of life and schooling. We have an economic problem here of no small proportions, and whether the mentality of the child is normal, sub-normal or above normal, it is obvious that any aid received through the eyes will improve their condition and the school condition generally.

In closing, I take pleasure in acknowledging the able assistance rendered by Dr. A. M. Magary and Miss Ebba Carlson who assisted in a very practical manner in the co-ordination and preparation of the data pertaining to the Graphs and in their construction.

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INTRODUCTION TO THE SHEPARD TECHNIQUE OF SUBJECTIVE REFRACTION*

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For more years than Optometry has been known, errors of refraction of the human eye have been measured and corrected according to the subject's ability to correctly name letters of a certain pattern and of measured sizes, as various lenses were placed before the subject's eyes. The practical value of the method cannot be denied in the face of its long continued popularity. Nevertheless, every optometrist more or less frequently finds himself confronted by a case in which the "Subjective Method" becomes a source of mental torment both to himself and the patient. Yet the vast majority of practical optometrists feel that subjective findings are most convincing in spite of the undisputed value of objective methods. The average patient believes that his eyes were given him to see with, and that is precisely what he proposes to do with them before he admits the doctor to be correct in his diagnosis. Therefore, subjective methods will probably always continue in popularity and it behooves us not to neglect possibilities in their further advancement.

Years ago, in the early days of private practice, Dr. Shepard evolved a simple technique for the subjective refraction of illiterates, foreigners, and deaf patients. Throughout the succeeding years the technique has demonstrated its efficiency, not only in those cases for which it was originally intended, but in every sort of case; especially when speed and precision are prime factors. No effort has been made to popularize the technique, but there is now evidence of a demand for cards especially suited to it. Such cards and charts may some day be printed, but before they are it is advisable that the techinque be thoroughly tried out by many practitioners. Standardized equipment tends to standardize methods, and too early standardization is not always conducive to further development. Therefore, this introduction to the technique is in a manner calculated to make the technique immediately available without expense to all those who find interest and value in investigating new ideas.

Because of the utter simplicity of the technique and charts involved it might be advisable to proceed the actual presentation of the technique by a discourse on the fundamental principals involved in order to establish the real value of the technique itself from an academic point of view. But theoretical discussions are of interest to relatively few, so the practical

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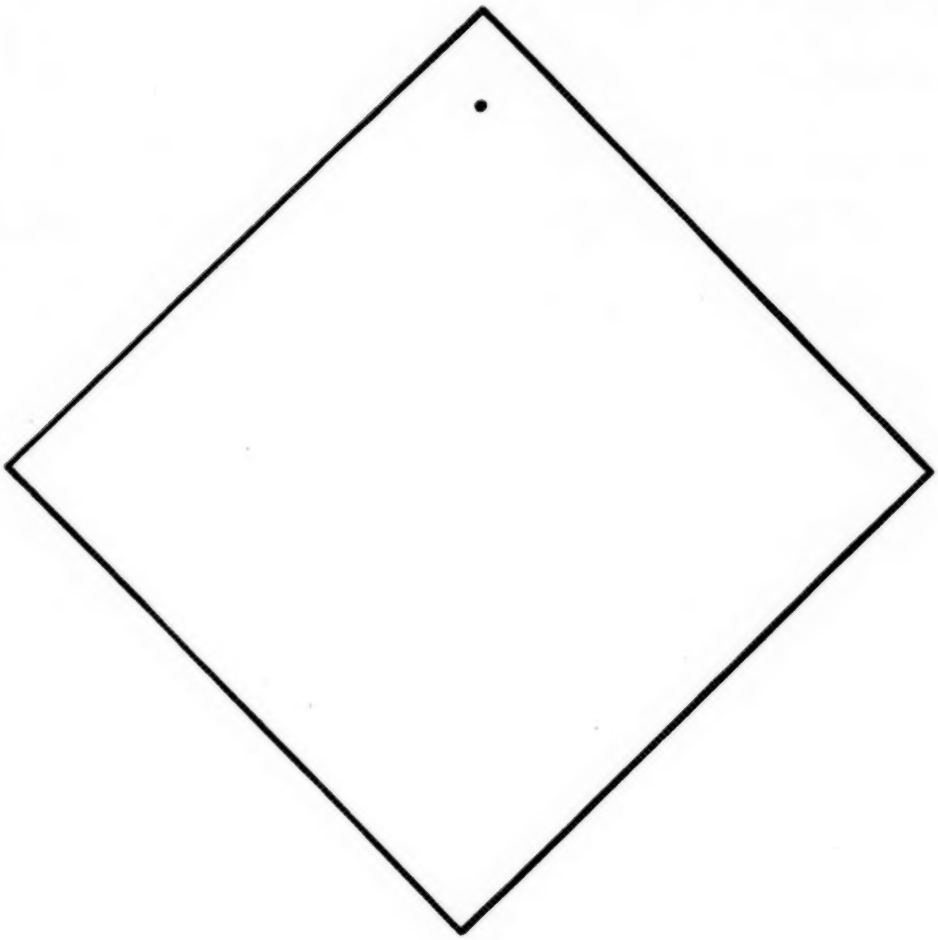

FIGURE 1.
SHEPARD TECHNIQUE
OF
SUBJECTIVE REFRACTION

side is presented now; and the theoretical side may be presented at some future time if sufficient interest justifies its discussion. Suffice to say here that there is being presented a subjective method of determining *the error of refraction.* Resolving power, comprehension of things seen, interpretation of retinal images, the ability for verbal expression of visual sensations, and the measurement of light perception are all factors to be considered in the development of any subjective method; but the purpose of the following technique is to reduce those factors to the lowest possible minimum.

The equipment necessary in the employment of the technique consists of the usual trial lenses, etc.; with the addition of an ordinary lead pencil, two pieces of white card board about ten inches square, and the ever present millimeter rule. The technique will be found much more convenient for those who employ a mirror instead of the full twenty-foot straight-away position for the test chart, but the latter will be able to apply it handily by having an assistant co-operate in the examination.

The patient is permitted to wear his old lenses, or an approximate correction as determined by retinoscopy, before which are placed an opaque disc occluding one eye, and a 1 m. m. pin-hole disc before the eye to be first measured. A small, round spot, no larger than a period, is made with the lead pencil within an inch or so of one corner of the white card. Ink should not be used to make the spot as a gray spot on a white field is better than a black spot.

The card is then presented, under proper illumination, in the patient's line of vision at the usual distance of twenty feet, but it should be held with the corner up, as shown in Figure 1, to expedite the patient's effort to describe its location. The patient is told that there is a small spot in one corner of the card, and asked to say in which corner. The answer will be: "Top," "Bottom," "Right," or "Left"; or "I don't know," as the case may be. If there is any reason to suspect "guessing" the card may be removed from the patient's line of vision and presented again with the spot in another corner.

The size of the spot is increased little by little until the location of it is positively determined by the patient. The opposite side of the card is used in the same way when the companion eye is to be refracted.

When controlled illumination is available, it is advisable at this point to reduce the illumination until the spot disappears, then to gradually increase the illumination until the spot is again just visible; using this minimum-practical illumination throughout the remainder of the procedure.

Now, plus sphere is added (all cyl. power being removed if any was present in the lenses formerly before the patient's eyes) until myopia of high degree is assuredly produced. Remove the pin-hole disc, leaving the companion eye occluded, and the spot should be invisible.

Referring to Figure 2. The focal lines FV and FH are both decidedly in front of the retina.

Now reduce the plus sphere by quarters until the patient can again definitely locate the spot. It may appear as two spots in high errors of astigmatism, but the point of consequence is whether or not he can say positively which corner of the card it is in. When the sphere has been reduced to this point, the spheric correction for that eye has been determined. Focal line FH, Figure 2, is now upon the retina.

In the meantime, an assistant should have drawn a straight line across the surface of another white card, using the same lead pencil, and the width

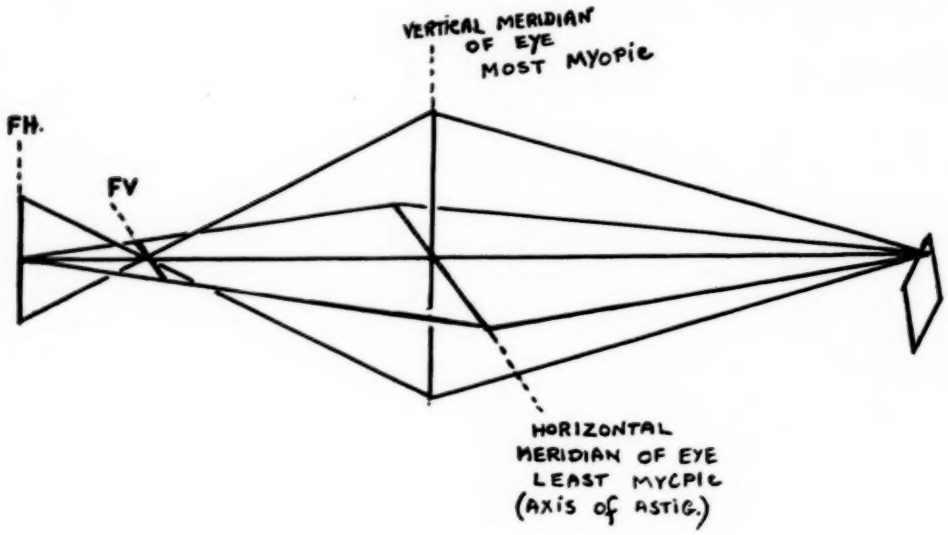

FIGURE 2

of the line should be approximately equal to the diameter of the round spot above described. If anything, the line should be a fraction narrower than the diameter of the spot, certainly not wider than the spot.

The card with the line across its face is now presented to the patient, at a distance of twenty feet, and slowly turned about the middle point of the line until the angle is found at which the line is seen most distinctly. In most cases, the line will be found to be practically invisible until placed at precisely the correct angle, corresponding to the meridian of greatest astigmatism in the patient's eye.

The meridonal position of the line is determined, and it is moved to the "opposite meridian," or at right angles to its former position; it will then be practically invisible to the patient.

Finally, place minus cylindric lenses before the patient's eye, axis corresponding (parallel) to the second position of the line upon the card, and increase the power by eighths or quarters until the line is again distinctly visible. At the expense of a little extra effort, two lines, crossed at right angles, may be employed instead of the simple straight line, thereby simplifying the actual procedure; but the suggestion was postponed until now for the sake of better understanding the principles.

Both focal lines FV and FH are now formed within the retina, and the total dioptric correction has been determined. The first refracted eye is occluded, and the companion eye treated in a like manner.

A final word of warning: By this technique, a "full correction" of hyperopia will result.

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SUGGESTIONS ON REFRACTIVE PROCEDURE AS DEVELOPED FROM FORTY YEARS OF OPTOMETRIC PRACTICE

Some few days ago the writer had the pleasure of spending several hours visiting with an optometrist who has conducted a successful practice in a central western State for the past forty years. This man, in his local community, enjoys the confidence and respect of his fellow citizens, most of whom not only are his friends but are his patients as well. Knowing the splendid reputation this man enjoys the writer asked him to outline a few of the guiding principles which he must have unconsciously developed during the past forty years of refractive work. In other words, the writer was interested in knowing just what underlying fundamentals were combined to insure the success which had come to this man in his optometric practice. While refusing to be quoted, he did nevertheless let me have the following three suggestions which he claims, while they might violate many of the theoretical principles of ocular refraction, do, nevertheless, go far towards insuring the ultimate comfort of the patient. These principles are as follows:

First. *That it is better to equalize the correction if at all possible.* By this he means, when the objective tests indicate a slight difference between the prescription for the right eye and that of the left, it is better to prescribe the same correction for each eye providing, of course, the subjective findings will permit this.

Second. *When the axis of one cylinder is 90° or 180° and the axis of the cylinder for the other eye is* (apparently in the objective tests) *80°*

or 85° or 95° or 100°, or 5° or 10°, or 170° or 175°, it is better to prescribe both cylinders with their respective axes, 90° or 180°, claiming that when both cylinders, in cases with the rule, are the same the patient will be more comfortable despite the fact that the ophthalmometer and skiascope show conclusively that the cylinder would be, in one eye, from 5° to 10° different from that cylinder prescribed for the other eye.

In the third place, he claimed that he *never prescribed a cylinder unless the visual acuity was materially benefited by so doing,* irrespective of the refractive data which might indicate the use of weak cylinders.

Obviously this practitioner has developed a sureness of touch in his work with his patients which enables him to ignore the findings in certain cases of refractive error and to substitute, unconsciously perhaps, from his sureness of touch, the necessary formula which will be most comfortably accepted by these particular patients. Naturally these fundamentals which he claims he follows apply only to patients having a relatively low degree of refractive error and muscular imbalance. Anisometropic patients and patients with high degrees of astigmatism must naturally have these conditions carefully and accurately prescribed for, according to the findings of both the objective and subjective tests. Yet it is interesting to review these principles which have slowly developed in the mind and technique of this man during some forty years of practice.

The writer has had no experience himself in following these tenets, being himself rather a slave to his objective findings, and for this reason perhaps finds the suggestions as outlined above both interesting and unusual and wondering at the same time how many other optometrists have developed, perhaps unconsciously, a similar set of guide-posts with which they chart the refractive seas. We will be interested in hearing just what reactions our readers have to the foregoing.

C. C. K.

BOOK NOTICES

SLIT LAMP MICROSCOPY OF THE LIVING EYE. By Dr. F. Ed. Koby. Translated from French by C. Goulden and C. L. Harris. Second Edition. Published by the P. Blakiston's Son and Co., Inc., Philadelphia, Pa. 360 pages. 104 illustrations. Price $4.50.

Slit-lamp Microscopy of the Living Eye was originally written in French by Dr. F. Ed. Koby and represents the results of several years of clinical experience and investigation as well as the researches of the accomplishments of other investigators in this field, most of whom are found amongst the German and Swiss scientists.

The book is made up of nine chapters. All chapters have a similarity of arrangement of the contents of the material, the technique of examination of the organ under consideration; normal appearance; congenital

anomalies; senile modification; tranmatic lesions; pathological changes; etc. A complete discussion is to be found on these subjects: Phenomena of reflection of light by the ocular media, the conjunctiva, the cornea, the anterior chamber, the iris, the lens, the vitreous body.

The book is followed by a most complete and exhaustive bibliography which will be very helpful to the practitioner who wishes to make a thorough study of his subject.

J. I. K.

ABSTRACTS

OCULAR DIATHERMY. S. J. Hubley, M.D. May, 1930, "Eye, Ear, Nose & Throat Monthly."

The author reports results obtained during the past year with Diathermy in the treatment of Cataracts. He describes a headband electrode, using a moistened pad. He reports 80% successful cases in selected patients—meaning by that, nontraumatic cases with vision of 20/200 or better. He rejects other cases and patients with high blood pressure or a skeptical attitude toward the treatment.

The hazy and cloudy type of opacities give, it seems, best results. while the sharp speculed types, he reports, retain their original form and do not respond in spite of all treatment.

He reminds the practitioner to have care in warning the patient against shorts by touching water pipes or radiators.

Two cases are reported showing visual acuity improvement. The improved visual acuity usually came after three or four treatments, but somewhat lowered a few months later necessitating a resumption of the treatments.

G. L. Du. P.

THE CAUSES OF PHOTOPHOBIA. O. C. Weathersbee. The Optician. (British). Vol. LXXVI, No. 1961, pp. 157-158. 1928.

Photophobia, according to Weathersbee, often accompanies diseases of the eye, being an almost certain concomitant of irritation of the conjunctiva, cornea, iris, or ciliary body. It is commonly met with in albinism, or where there are abnormally large pupils, coloboma or large iridectomy of the iris, and is then due to excess of light. Hyperaesthesia of the retina due to exposure to bright lights, glare, strain through working in a dull light, neurasthenia, hysteria, and some forms of neuralgia claims photophobia as a prominent symptom. It is, he claims, also a frequent symptom where there is weakness or strain of the sphincter muscle of the iris, ciliary muscle, or of the extra ocular muscles.

T. O. B.

ANNOTATIONS AND SOCIETY PROCEEDINGS

The American Journal of Optometry is the Official Organ of the American Academy of Optometry, as well as the Organ of the Arkansas, Delaware, Indiana, Iowa, Maine, Maryland, Michigan, Minnesota, Nebraska, North Dakota, Oklahoma, Pennsylvania, South Dakota, Vermont and West Virginia Optometric Associations.

The following gentlemen have consented to supply items of interest from their respective sections, acting in the capacity of

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GLARE VS. ULTRA-VIOLET RADIATIONS

That glare is an eye-disturbing element in light, says Mr. F. Romer of Washington, D. C., is a conclusion long reached and preached by the optometric profession. There is no argument about the harm of glare. Scientific research has established through practical experiments and investigations the fact that glare in its modern form exerts a dangerous influence upon the human eye. Not only has it been brought out that glare causes strain, weakness and severe irritation of the retina, but recent investigations have shown that it also lowers mental and physical efficiency, preventing the most satisfactory and sustained type of work or rest. Already we see in the lighting and building professions a concerted effort to eliminate glare from school rooms, office buildings, apartments and all places where people spend much of their time either for work or recreation.

Today optometrists are seriously dealing with glare and the practice of testing even normal eyes for glare sensitiveness is a growing one. But, continues Romer, many optometrists are uncertain as to the best methods to be employed in effecting glare elimination. Very little was known about the cause of glare until a comparative recent period. Up to the present time a false idea prevailed among some that the ultra-violet ray was the "glare ray" in light. Even among scientists there were some who held to the belief that if the ultra-violet was removed there would be no further need to fight glare—because glare would go with it. Unfortunately, this is not true. The ultra-violet can be removed easily, of course, but its removal does not eliminate glare.

This idea probably got its conception from the fact that when glare is absorbed a certain amount of the ultra-violet is absorbed also. The

amount depends largely upon the lens employed to cut out the glare. Some glare absorbing lenses remove more of the ultra-violet than others. Some remove hardly any. Speaking of glasses that remove glare, W. W. Coblenz in his important work, "The Transmissive Properties of Eye-Protective Glasses and Other Substances," refers to their power over the ultra-violet ray in the following manner:

"The use of such glasses will reduce also the intensity of the ultra-violet rays which have already been selectively absorbed by reflection from terrestial objects. It is a common property of most substances (for example, growing vegetation, brown sand, clay, granolithic material), that the reflecting power for ultra-violet is lower than for visible radiation. Hence, a spectacle glass that will reduce the glare of the sunlight will also reduce the utra-violet."

Just what happens when the ultra-violet is removed has long been a subject of scientific discussion. Some of our leading scientists hold to the opinion that it is harmful to remove the ultra-violet ray. They call it the "health-giving ray." By some it is said to bring strength and energy to the eyes just as it does to the body. Coblenz in his treatise brings up the discussion but does not answer it. He says:

"Ophthalmologists are sometimes confronted with antagonistic claims regarding the effect of ultra-violet solar radiation on the eye. In view of the fact that the human eye is accustomed to ordinary intensities of unfiltered sunlight there seems to be no need of considering the question of injury by the ultra-violet present in daylight."

On the other hand, continues Romer, Coblenz is not altogether convinced that it is necessary to admit the ultra-violet ray for health-giving purposes. But, in spite of the many divergent opinions on the subject, scientists everywhere are agreed that the ultra-violet has nothing to do with glare,—which was the original point of this article. Glare is an individual element in light, separate and apart from any necessary constituent. Glare produces a definite result upon vision. It irritates, excites and constantly contracts the eyes causing strain and general visual weakness. The harm of glare can be easily determined by a very simple experiment anybody can perform. No amount of experiment has definitely revealed the true character of the ultra-violet ray in relation to vision, although the opinion seems to be spreading that it is a beneficial and important health giving element in light—as good for the eyes as it is for the body.

Modern science has, in my belief, says Romer, come to appreciate the importance of the ultra-violet ray in its action upon the human body. It is only fair to assume that some of these same beneficial health-giving qualities are captured and retained by the human eye. Already many refractionists are convinced of the value of the ultra-violet ray in prescribing for their patients. Opinion has been directed so steadily toward this belief that today glare absorbing lenses are being worn that remove scarcely any of the ultra-violet. Their use has been so successful that the modern tendency is to prescribe against glare, so as to preserve the ultra-violet through the use of these new style lenses. This practice tends

more and more, claims Romer, to strengthen the contention that the ultra-violet *is* beneficial to the eyes.

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LECTURES ON PHYSIOTHERAPY

At the request of a number of optometrists residing in the Central West, Dr. J. I. Kurtz, Optometrist, of Minneapolis, author of "Principles and Practice of Ocular Physical Therapy for Optometrists," will give a series of lectures during the month of December in Ohio, Indiana, Illinois, Iowa, Michigan, Wisconsin and Nebraska. In all probability there will be but one day spent in each state on lectures and clinical demonstration on the application of Ocular Physical-therapy technique. The exact date and place of meeting will be announced in the November issue of the American Journal of Optometry. Optometrists wishing further particulars regarding this series of talks may address Sec'y. Kurtz, Lecture Tour, 1502 Foshay Tower, Minneapolis, Minnesota.

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THE POST-GRADUATE EYE INSTITUTE

Dr. Carl F. Shepard and Dr. Wm. Mendelsohn, two well known optometric educators, have announced the establishment of a Post-graduate Eye Institute to be located at 863 North La Salle Street, Chicago, Illinois. A three-story building has been acquired and is being remodeled to serve the needs of the Institute. Laboratory facilities, class rooms, library and graduate clinic will occupy the building, in which optometrists from all parts of America will participate.

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A CORRECTION

The sentence starting on line 37, page 490 of the September issue of the American Journal of Optometry, in the article by Dr. Philip Pollack should read:—

In an investigated case of external ophthalmoplegia, the Edinger-Westphal group was undisturbed, but almost the entire remainder of the oculomotor nucleus was gone.[2]

ALSO the following References were omitted at the end of the paper:

(17) Sheard, C. Dynamic Skiametry and Methods of Testing the Accommodation and Convergence of the Eyes. 1920. (a) pg. 22. (b) pg. 18. (c) pg. 19.

(18) Tait, E. F. A Quantitative System of Dynamic Skiametry. American Journal Optometry. 1929. v. 6, No. 12. pp. 669-693.

(20) Pollack, Ph. The Limitations of Dynamic Skiametry. American Journal Optometry. July, 1930. v. 7, No. 7. pp. 396-401.

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MODERN OPTOMETRIC PRACTICE

At the request of many optometrists, Dr. T. G. Atkinson, Author, Lecturer and Editor of the Eye, Ear, Nose and Throat Monthly, is preparing a series of booklets containing data on up-to-date optometric practice and other allied subjects. Dr. Atkinson in his usual prac-

tical style sums up in these booklets what he claims is the latest information of interest to the modern optometrists. The series consist of the following monographs: 1. The Truth About the Muscles. 2. Visual Field Charting. 3. Extra Ocular Tests. 4. Focal Diseases and the Eye. 5. Psychoanalysis in Optometry. 6. Easy Differentiation of Eye Diseases. The price of any one of these booklets is 50c or $2.50 for the entire series. Orders should be sent direct to Dr. T. Atkinson, 5 North Wabash Avenue, Chicago, Illinois.

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DR. WHEELOCK APPOINTED STATE EDITOR

Dr. V. V. Kirby, President of the Iowa State Association of Optometrists, appointed Dr. A. P. Wheelock of Des Moines as State Editor, to represent Iowa's State Association on the editorial staff of the American Journal of Optometry. Dr. Wheelock is vice-president of the Iowa Association and is in charge of the publicity work for the State Association.

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PANHANDLE OPTOMETRIC SOCIETY

The Panhandle Optometric Society of Texas met recently in the office of Dr. J. M. Hyden of Amarillo. Dr. C. M. Clough of Plainview read a paper on Important Brain Facts and Their Relation to the Eye. Dr. J. M. Hyden read a paper on the Treatment of Myopia and Dr. T. M. Montgomery, who is president of the society, spoke on Ophthalmoscopic Procedure. Dr. A. M. Skeffington of the Graduate Clinic Foundation, it was announced, will conduct a Clinic in Amarillo on October 22, 23 and 24. The next meeting of the society will be held in Plainview.

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VIRGINIA OPTOMETRIC ASSOCIATION

According to Dr. F. D. Jackson, Secretary of the Virginia Optometric Association, the annual meeting of this body will be held at Farmville, Virginia, on October 20th. The meeting will be held at Hotel Weyanoke, the arrangements being in charge of Dr. R. J. Martin.

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THREE COMING ISSUES

Believing that it would be of interest to our readers to know just what original material will be presented in the coming issues of the American Journal of Optometry, we have prepared the following schedule of original papers which will appear in the November, December and January issues:

In the November issue the following original papers will appear: *Study of the Torsions with a Report of a Case of Total Disassociation of the Fusion Faculty,* by Dr. Frank H. Robertson. *Eye Strain and General Physical Health,* by Dr. Albert N. Prussin. *An Optometrist's Bag of Tricks* by Dr. Jos. I. Pascal and Chapter VII of Dr. Heather's article on *Chromagraphology.* This chapter deals with focal infections and their interpretations by means of charting the visual field.

In the December issue of the American Journal of Optometry the fol-

lowing original papers will appear: *A Study of the Visual Portion of the Autonomic Nervous System* by Dr. E. G. Wiseman. *The F-L Test, and My Experiences With It* by Dr. Oscar L. McCulloch. *Three Studies in Eye Pathologies Treated by Light Therapy* by Dr. W. W. Roepke. *Speedy Lateral Phoria Determination* by Dr. Paul Dill and a *Differential Diagnosis in Optometry* by Dr. William Smith.

In the January issue, the following original papers will be presented: *A Case of Hyperopic Astigma Which Developed into Compound Myopic Astigma,* by Dr. Arne T. Wray. *A Technique for The Observation of the Macular Area,* by Dr. Chas. I. Saks. *Diplopia in the Treatment of Strabismus* by Dr. Jos. I Pascal. *The Anomalies of the Phoria* by Dr. N. Levin, and *Ocular Headaches, Its Differentiation and Meaning,* by Dr. B. T. Hoffman.

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BROADCASTING EYE CONSERVATION

During the past month the Shur-on Standard Optical Company have started broadcasting a series of programs of musical character every Sunday afternoon in which the theme of Eye Conservation will be stressed. This program is put on the air, by one of the large chain hook-ups and reaches nearly every portion of America.

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MAINE ASSOCIATION MEETING

The regular meeting of the Maine Association of Optometrists was held in Houlton on Sept. 8. Dr. W. A. Small of Caribou presented a paper on Dynamic Skiametry and Dr. Philip Dean of Lincoln presented one on the Relative Facts of the Convergence Clinical Value.

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HARTFORD COUNTY ASSOCIATION

The Hartford County Optometric Association held its first fall meeting on Tuesday, Sept. 23. This society will meet on the 2nd and 4th Tuesday of each month, according to Dr. F. E. Harrigan. The work of the Graduate Clinic Foundation will be followed during the winter.

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BETTER VISION INSTITUTE

The Better Vision Institute of New York City announce that they have arranged for the publication in the October issue of Review of Reviews an article on Conservation of Vision. This article was written by the famous War-correspondent of the Chicago Tribune, Mr. Floyd Gibbons. This article, they assure us, is very well written and for this reason it has been reprinted by the Better Vision Institute for general distribution. Optometrists who are interested should address the Institute at 611 Graybar Building, 420 Lexington Ave., New York City.

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